

THE ANALYST.

MARCH, 1892.

PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.

A MEETING of the Society was held on the 3rd February, the President being in the chair.

The minutes of the last meeting were read and confirmed.

Mr. W. Chattaway was proposed as a member, and Mr. J. S. S. Brame, Assistant to Mr. Embrey, was proposed by the Council as an associate.

The President had pleasure in announcing that the Library of the Chemical Society would be open until 9 o'clock on the evenings on which the Society met.

The following gentlemen were duly elected:—

As honorary member:—P. Vieth, Ph.D., F.I.C., F.C.S., Analytical Chemist.

As members:—Benedict Kitto, F.I.C., F.G.S., 30 & 31, St. Swithin's Lane, E.C., Public Analyst for Cornwall; George Pilkington, F.I.C., 28, Pall Mall, Manchester, Analytical and Consulting Chemist; S. A. Vasey, F.I.C., F.C.S., Arncliffe, Drayton Road, Leytonstone, Analytical Chemist; John Cuthbert Welch, F.C.S., The Brewery, Reading, Analytical and Consulting Chemist.

As associates:—E. C. P. Barber, 34, Mount Preston, Leeds, Assistant to Mr. Fairley; H. S. Haller, Royal Chambers, Scale Lane, Hull, Assistant to Mr. Baynes.

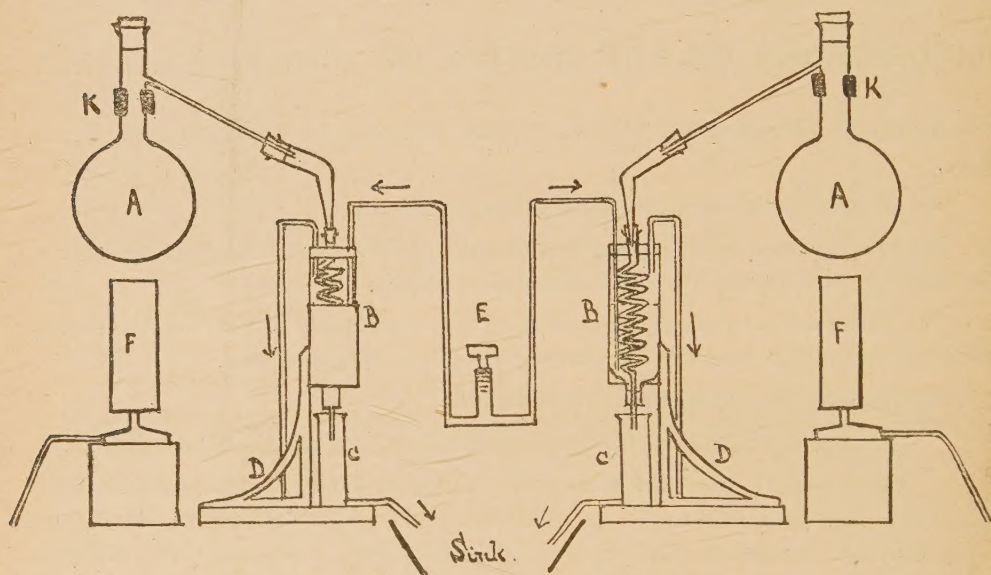
Mr. Embrey then read the following paper:—

A CONVENIENT METHOD FOR ARRANGING THE APPARATUS USED IN DETERMINING FREE AND ALBUMINOID AMMONIA.

BY G. EMBREY, F.C.S.

IN the beginning of 1891, the citizens of Gloucester received the unwelcome news that the ordinary water supply was exhausted, and it became necessary at very short notice

to find some new ones. The river Severn at Gloucester is affected by the tide for about ten or twelve days during the month, and, as some seven or eight towns furnish it with a plentiful supply of sewage, there seemed only two sources: first, the Gloucester and Berkeley Ship Canal: and, second, numerous unused wells. Before sanctioning the use of these latter, it was thought by the authorities desirable to have an analysis made of each. Finding the ordinary clumsy arrangement of apparatus unsuitable, and having to make some twelve or more analyses each day, I set to work, with the help of a mechanically-inclined assistant, to devise an arrangement which I believe superior to that in common use; the ordinary clumsy retort and condenser takes up too much room and only one operation can be conveniently managed at one time. What I required was an arrangement so that two analyses could be kept going by one assistant.



My laboratory tables are 8 feet long, and 2 feet 3 inches wide, with a small sink with water tap in the middle. On each side of this sink was fitted a distilling flask with spiral condenser, the source of heat being an argand burner with iron chimney 8 inches high and 2 inches wide. As I had no room for retort stands, I contrived a simple clip screwed on to the shelf at back of bench; this keeps the table free for work. I find the burner can be turned up so that the flame reaches nearly to the top of the chimney, and there is no fear of cracking the flask; the water boiling in a few minutes, the condensation is far better than with the ordinary arrangement of straight Liebig condenser.

I find that by starting one analysis a little before the other, one assistant can perform two determinations in a little over an hour; so that myself and two assistants,

working eight hours, could make forty-eight determinations of free and albumenoid ammonia in one day. Though this speed was never reached, we came very near it. It will be noticed that a small convenient adaptor connects the flask with the condenser, the corks are covered with tin-foil, this being kept in place by a strong india rubber band. I would call attention to a convenient method of holding the spiral condenser: a small tin cup fastened to an iron bracket, this latter screwed to a wooden base with four screws at the corners, underside; this keeps it from moving about.

DESCRIPTION OF SKETCH SHOWING WATER APPARATUS.

- A A Distilling flasks.
- B B Spiral condensers.
- C C Nessler glasses.
- D D Brackets supporting condensers.
- E Water tap.
- F F Argand burners.
- K K Clips fastened to shelf.

DISCUSSION.

Mr. Cassal said that it had been his practice for many years to make use of a 40 to 45 ounce boiling flask for estimating ammonia in water analysis. He used a narrow glass condenser, 30 inches long, and of an inch internal diameter, with a straight condensing tube about 44 inches total length, but bent about 5 inches from the end, passing into the flask so as to give about 39 inches of straight length. The internal diameter of the condensing tube was half an inch. He preferred a straight condenser enclosed in a glass jacket, although he could well believe that Mr. Embrey's form of apparatus might be advantageous in small laboratories.

An important statement made by Mr. Embrey was that he obtained more perfect condensation with a spiral condenser, and could estimate saline ammonia which was not detectable by using the old form of apparatus. There was no doubt that the old metal condensers and accessory apparatus were cumbrous arrangements, devised rather for preventing satisfactory results than getting them.

Mr. Embrey in reply, said that the only point raised seemed to him to be the one of more perfect condensation. Everybody who had a large experience of Water Analysis with a straight condenser had seen steam at some time or other, in the early part of the process, issuing from the mouth of the straight condenser no matter how long the tube might be; this steam cannot be perfectly free from ammonia. In a spiral condenser there was the advantage that there was always a column of liquid present, and it seemed almost impossible for any steam to escape.

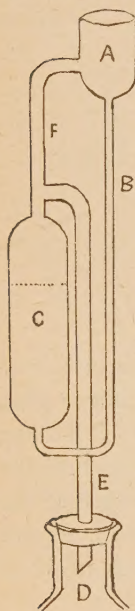
In the absence of the author, Mr. Dyer read the following paper :—

A NEW FORM OF FAT-EXTRACTION APPARATUS FOR LIQUIDS.

BY ALFRED SMETHAM, F.C.S., F.I.C.

SOME years ago I devised a form of fat-extraction apparatus for solids on the principle of upward filtration, but as it presented no advantages over the now well-known Soxhlet form I did not deem it desirable to publish an account of it. A few months ago, however, I had occasion to extract some liquids with ether, and it occurred to me that the apparatus might be pressed into service for that purpose; and as it answered all my expectations, I modified it somewhat in form and have now used it in my laboratory for some six months

or so. As it has been very serviceable to me, I venture to give a description of it to the Society in the hope that it may be useful to others—more particularly as it is specially adapted to the extraction of fat by the Schmid process.



The working of the apparatus will be easily understood by a glance at the accompanying diagram. The liquid to be extracted is poured into cup A so that the whole of it will run down the tube B into the bulb C, which should not be more than about two-thirds full. About 5 c.c. of ether are poured into a tared flask D, attached to the tube E by a cork in the usual way. The bulb C is then completely filled by adding ether carefully to the cup A, and the whole is adapted to an upright condenser—as with a Soxhlet tube. When the flask D is immersed in hot water, the ether vapour passes along the tubes E and F, is condensed in the Liebig's condenser and runs back by B into C, and rises drop by drop through the liquid to be extracted. The process is, therefore, continuous and automatic, and may be applied to any two non-miscible liquids, provided the solvent be the lighter.

To the Public Analyst it will, I apprehend, be chiefly of value because of its applicability to the extraction of fat from milk and its products; especially when treated by the Schmid process. For this purpose 10 c.c. of the sample under examination are measured or weighed into a little beaker, 10 c.c. of hydrochloric acid added, and the mixture gently boiled with constant stirring for two or three minutes. When cold, the mixture is poured into the apparatus as described and the beaker washed with ether and the washings added. The apparatus is then put together and the extraction allowed to proceed for an hour or so, when the whole of the fat will be found in the flask D. As there is only a small quantity of ether with the fat, the flask may be placed directly into the water-oven and the contents weighed to constancy in the usual way. The whole operation, so far as actual worth is concerned, can be performed very rapidly and with great ease and accuracy; the only error entering into the process being, so far as I have been able to ascertain, the slight solubility of some caramel-looking matter, which contaminates the fat to the extent of a milligram or two.

So far as my experience goes it appears that the extraction of the fat is more rapid

the more perfectly the milk and acid have been boiled together. Thus, when boiled for three minutes, practically the whole of the fat is removed in half an hour; whereas, when only boiled for two minutes, in one instance, 31 milligrams remained unextracted at the end of that time; while when boiled for one minute only about two-thirds of the total fat was extracted, the remainder being removed with difficulty. It would appear, therefore, that to readily extract the whole of the fat, it is necessary to boil the milk and acid together for some time, say three minutes.

The following results, obtained with four different samples of milk, and taken in this order, will give some idea of the accuracy of the process under varying conditions:—

		Schmid. Boiled with H.Cl. for 1 minute	2 minutes	3 minutes	5 minutes	Adams method. Extracted 3 hours
1.	Extracted 3 hours			2.60		2.49
2.	„ $\frac{1}{2}$ hour		3.91	4.49		
	„ 1 „		4.21	4.53		
	„ $1\frac{1}{2}$ hours		4.46	4.56		4.51
3.	„ $\frac{1}{2}$ hour		2.61	2.69		
	„ 1 hour		2.75	2.75		
	„ 2 hours		2.78	2.80		2.78
4.	„ $\frac{1}{2}$ hour	2.31			3.46	
	„ 1 „	3.33			3.51	
	„ $1\frac{1}{2}$ hours	3.49			3.56	
	„ $2\frac{1}{2}$ „	3.61				3.57

The determinations by the Adam's process were made by the use of Schleicher and Schüll's Fat-free paper, and the extraction was continued for three hours.

DISCUSSION.

Dr. Sykes pointed out that an apparatus with the same object had been recently described in "THE ANALYST," and which appeared to him to be much simpler and less fragile than the one described by Mr. Smetham. He also thought that Mr. Smetham's apparatus would be very difficult to clean, whereas the other one offered much less difficulty in this direction. The paper he alluded to was "On the Estimation of Mixtures of Saponifiable and Unsaponifiable Fats," by Hönig and Spitz, vol. xvi., p. 238.

Mr. Bernard Dyer would like to say that Mr. Smetham was perfectly aware of the existence of the apparatus referred to by Dr. Sykes; but Mr. Smetham's opinion was that his apparatus was simpler, better, and more workable. Messrs. Hönig and Spitz had happened, independently, to drop upon exactly the same principle.

The following paper was then read by the author:—

ON THE DRAWING UP OF CERTIFICATES.

By CHARLES E. CASSAL.

This concluded the proceedings of the Society.

NOTES FROM THE KHEDIVĀL LABORATORY, CAIRO.

By H. DROOP RICHMOND.

Read at the Meeting, November 4th, 1891.

4. **On Gamoose Butter.**—In the Journal of the Chemical Society, lvii., 757, in conjunction with A. Pappel, I gave figures of analysis of gamoose butter; the samples examined then were taken in the winter when, owing to the necessities of the country, the animals are exclusively stall-fed; I have now had the advantage of examining many samples of butter prepared in the summer months when, on the contrary, the animals are all out to pasture, and I find that important differences exist. The following are the chief figures obtained in the examination of these samples; for the sake of comparison the winter figures are added:—

		Summer.			Winter.
Potash for saponification	... ..	23.17	... ..	...	22.04
Insoluble fatty acids	... ..	86.9	... ..	...	87.5
Of which (mean combining weight)		265.0	... ..	...	270.5
„ (Iodine Absorption)	... ..	35.1	... ..	...	41.8
Iodine Absorption	... ..	32.0	... ..	...	35.0
Soluble fatty acids (as butyric)	... ..	6.99	... ..	...	6.09
Reichert-Wollny	... ..	34.7 c.c.	$\frac{N}{10}$ Alk.	...	25.4 c.c. $\frac{N}{10}$ Alk.

The maxima and minima are respectively:—

		Max.			Min.
Potash for saponification	... ..	23.33	... ..	...	22.86
Insoluble Fatty Acids	... ..	87.3	... ..	...	86.7
Iodine Absorption	... ..	32.5	... ..	...	31.6
Reichert-Wollny	... ..	39.0 c.c.	... ..	...	30.65 c.c.

Special attention was paid to the Reichert-Wollny determinations, this figure being taken for all samples which was not the case with the others. With regard to the sample giving 39.0 c.c. it was remarked that it was very liquid, and the portion fluid at 17° took 41.3 c.c.; on this being cooled to 0°, it did not completely solidify, and the liquid portion separated at that temperature took 45 c.c. $\frac{N}{10}$ baryta solution to neutralise the volatile acids; the sample was then unfortunately too small to admit of the other properties being examined; this is probably the highest Reichert-Wollny figure obtained from a butter. With regard to this, it may be interesting here to record an experiment made some years ago in England. A butter which took 26.1 c.c. $\frac{N}{10}$ R.-W. was melted and allowed to cool very slowly at about 25° C., being separated into portions, liquid and solid, which gave the following figures respectively:—

		Solid.			Liquid.
Reichert-Wollny	... ..	19.9 c.c.	... ..	...	31.6 c.c.
Iodine Absorbed	... ..	27.6	... ..	...	37.5
Density at 15° C.	... ..	—	... ..	...	.922

These figures show that the liquid portion contains not only more volatile acids, but

also more unsaturated acids; the density also is lower, Fleischmann (*Landwirth*, xxxiii., 251), giving the density of butter as .9307 on the average.

The great variations found have led me to search for indications of other methods of determining the purity of a butter than the usual determinations. I have long been of opinion that some regard should be paid to the ratio that the various figures bear to each other; this idea has been utilised by Muter (*ANALYST*, xv., 88), who proposes the ratio between the Reichert figure, and the index of refraction as given by Jean's oleo-refractometer as a means of detecting cocoa-nut oil. I have further developed this idea; from the absorption of potash, and the insoluble fatty acids (assuming that they have a constant mean combining weight), we can calculate the soluble fatty acids (as butyric), and assuming that a constant proportion of these passes into the distillate, we can calculate also the Reichert-Wollny figure; for the butter of the Gamoose, I take the following figures as the means for the combining weight, and the proportion of fatty acids distilling respectively 265 and 82 per cent., and using these I calculate the following formula:— $7.31 K - 1.55 I = R.-W.$ $K =$ Potash absorbed, $I =$ Insoluble fatty acids and $R.-W. =$ Reichert-Wollny figure.

This formula I have applied to the following samples with good results:—

Insoluble Fatty Acids.	Potash Absorbed.	Reichert-Wollny found.	Calc.
87.5	22.04	25.4	25.5
87.15	22.87	32.3	32.1
86.9	23.17	34.7	34.7
86.7	23.33	36.2	36.15

Considering that the formula was obtained theoretically it is astonishing how close the results are, and although the number of samples is small, this agreement shows that there is a relation between the three figures. It is worthy of note that the summer and the winter butter, although very different in their figures, show that the same relation exists.

If now a butter be adulterated with cocoa-nut oil, this relation is changed, the calculated Reichert-Wollny figure coming out much too high, as in this oil only a very small portion of the soluble acids are volatile, certainly very much less than 82 per cent; the quantity of cocoa-nut oil may be calculated from the ratio of the difference between the calculated figure, and that found, to the difference between the calculated figure and 7 (the figure given on the average for cocoa-nut oil).

This equation does not apply to cows butter as is shown by the figures published by Allen (*ANALYST* xv., 4).

Insoluble fatty acids.	Potash Absorbed.	R.-W. found.	R.-W. Calc.	Diff.
90.4	22.16	22.5	21.9	— .6
90.1	22.09	24.55	21.9	— 2.65
88.5	22.67	29.2	28.3	— .9

I have no other analysis at my disposal, but this discrepancy confirms the conclusion to which Pappel and I had arrived, that the Reichert-Wollny figure is low in Gamoose

butter as compared to the other figures; it will be interesting for any analysts, having samples of butter on which they have made the necessary determinations, to apply the formula with margarine; also the ratio is not the same as in butter, but the difference is so small that this method would not indicate such quantities as 10 per cent. or 20 per cent.

Another indication which I publish, in the hope that other chemists may verify or disprove the theory I have founded on it with European butters, has occurred to me from the following figures obtained from three butters, which were submitted to a fairly complete analysis:—

			1	2	3
Mean combining weight of fatty acids	...	...	264.0	265.7	270.5
Iodine Absorption	„	„	34.9	35.2	41.8

From these it is seen that the iodine absorption is increasing with the mean combining weight, indicating that the unsaturated acids have a higher mean combining weight than the saturated. From the average of these I calculate that .837 per cent. Iodine absorbed causes an increase in the mean combining weight of 1, and employing this figure, I calculate that the mean combining weight of the saturated fatty acids in 1, 2 and 3 respectively is 235.5, 236.2, and 234.8—average 235.5; and of the unsaturated acids 305.0, 305.0 and 303.6—average 304.5; these acids would absorb 83.2 per cent. of Iodine; with regard to this it is interesting to note that Pappel and myself (*loc. cit.*), found 297 as the mean combining weight of the unsaturated fatty acids of No. 3, and as the quantity operated on was less than half a gram., this number is in fairly satisfactory agreement with that calculated. I put forward this as it is not unreasonable to hope that the mean combining weight of the saturated fatty acids (at least), is sufficiently constant and sufficiently far removed from that of those of margarine, to be used as a means of discriminating between abnormal and adulterated butter; and I invite any chemists who have the time and the opportunity to make experiments, to determine whether this is the case with European butters; I regret that being in a far country I am unable to do this myself.

5. Fat Extraction and Fat Calculation in Milk Analysis.—In a paper published in THE ANALYST, xvii. 203, Dr. Vieth states that he is unable to accept my statement that the increasing difference between the paper and plaster methods as the amount of fat rises is only an apparent one, and does not accept my reasoning that, although the actual quantity is larger, it is a smaller proportion. As perhaps Dr. Vieth's opinion on this question is of more weight than that of any other analyst, I put forward more facts and arguments in support of my theory of milk extraction, hoping that by discussing the question fully we may arrive at a conclusion which can be accepted by both of us.

It behoves us first to consider what are actually the conditions when milk is dried up on paper and plaster respectively; taking, to begin with, the case of the paper, I cannot consider that paper is analogous in its action to that of a porous clay plate. I am of opinion that on filtering milk through filter paper, the filtrate is a watery solution of the solids not fat almost in their entirety together with .1 — .2 per cent fat, and that very

little of the casein remains with the fat. In support of this I quote the following determinations of the density of filtered milks, together with the solids not fat calculated therefrom by my formula; this last figure I correct by allowing for the loss of volume occupied by the fat, and on comparing this figure with the solids not fat actually found or calculated from the results of the analysis of the milk, it is seen that the agreement is very good indeed, and shows that very little of the casein is separated with the fat.

No.	Density.	S.N.F. calc.	S.N.F. corr.	S.N.F.		Diff.
				actual.	Of milk. calc.	
1.	1.0340	8.68	8.33	8.63	8.50	— .17
2.	1.0348	8.90	8.59	8.71	8.59	—
3.	1.0345	8.80	8.49	8.63	8.62	— .13
4.	1.0326	8.31	7.96	8.18	8.20	— .24
5.	1.0331	8.45	8.27	8.36	8.33	— .06

The average difference between the solids not fat calculated from the filtered milk, and corrected, and the solids not fat calculated from the milk itself is — .12 showing that very little of the casein separates with the fat. I have thought it just to take the calculated figure for comparison, as the error, due to the factors for the density of the solids not fat not being absolutely constant, is neutralised, and the figures are more strictly comparable.

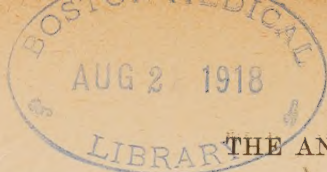
I consider, then, that it is right to say that in the paper process the fat is practically separated, and the conditions of extraction are the most favourable.

To consider now the case of plaster; when milk is absorbed by plaster, it does not undergo this separation to the same extent, although doubtless partially, and consequently there is fat distributed among the particles of the plaster; when the plaster sets, it forms a mass impermeable or difficultly permeable to ether, and a portion of the fat is enclosed in a coating which prevents its extraction. What, then, is more reasonable to suppose than that in a milk containing a large quantity of fat a larger quantity, though perhaps a smaller proportion, owing to the more complete separation of the fat, is enclosed, and removed from the ether, than in a milk poor in fat? I attribute, then, the difference to the fact that setting the plaster imprisons some of the milk solids, and if the milk contains in one case a much larger quantity of fat than in the other, it is to my mind justifiable to expect that the enclosed milk solids should also contain a larger quantity of fat which is not extracted.

In the case of direct evaporation, it is the solids not fat themselves which imprison the fat, and a precisely similar explanation of this increasing difference applies.

I hope that Dr. Vieth will now be able to accept my theory, or if not that he will discuss still further this question, I being anxious to settle it, as I am of opinion that in science no fact should be lost, and no theory left unexplained, however unimportant they may seem at the moment, as we can never tell their future value.

I am extremely obliged personally to Dr. Vieth for having corrected the figures for the proportion of ash proteids and sugar in milk, as I had found in the milk of the Gamoose



that the proportion was almost exactly 1 : 5 : 6, and I was perplexed to find the reason why the solids not fat of Gamoose milk had a lower density in solution than those of cows' milk. Employing the figures given on p. 127 of *THE ANALYST*, vol. xiv., I calculate that for the proportion 1 : 5 : 6 the density should be 1·62, and for the proportion 2 : 9 : 13 it should be 1·635, while I actually find 1·589 for Gamoose milk, and 1·613 for cows' milk, a difference of ·031 and ·022 respectively; this shows that the factors used are probably not absolutely exact, but at the same time it confirms the conclusion I had arrived at that between Gamoose milk and cows' milk, there was very little difference as far as the density of the constituents was concerned.

6. A Rapid Method of Milk Analysis.—I have shown in the preceding note that on filtering milk, it is practically separated into a solution of solids not fat in water and fat; if the density of the milk be taken before and after filtration, the density of the milk after filtration less 1 divided by ·004, very fairly represents the solids not fat, and the difference between the two divided by ·0008, the fat.

No.	Density.		Diff.	S.N.F.		Fat.	
	Before filtration.	After.		Found.	Calc.	Found.	Calc.
1.	1·0308	1·0340	·0032	8·63	8·50	3·94	4·0
2.	1·0318	1·0348	·0030	8·71	8·70	3·35	3·75
3.	1·0316	1·0345	·0029	8·63	8·63	3·61	3·62
4.	1·0298	1·0326	·0028	8·18	8·15	3·80	3·5
5.	1·0315	1·0331	·0016	8·36	8·27	1·99	2·0

Great exactitude cannot be expected, especially in the fat, but I think the figures quoted show that the method can be used by public analysts to sort out their milks.

DISCUSSION.

Dr. Vieth, in responding to the President's invitation, said that he felt that he was not acting altogether according to his own choice, but, so to speak, under compulsion, the paper being practically addressed to him. He wished first of all to thank the President for his kindness in giving him an opportunity of perusing the paper before it was read; and also to give expression to the pleasure with which he had listened to it. It was refreshing in our day to see an esteemed colleague exerting himself in the cause of truth solely for the sake of truth and science. In discussing the paper he felt he was working under two disadvantages; firstly, he had to do so in the absence of the author of the paper; and secondly, he could not expect that the majority of the Members of the Society should take a deep interest in a purely theoretical question of no practical consequence, and very little importance. He would try to be as brief as possible. Mr. Richmond, in the first part of his paper said that he could not consider paper analagous in its action to that of a porous clay plate. Perhaps it was not; but he questioned whether Mr. Richmond's filtration experiments proved that, what he had found, invariably took place when milk was put on filter or blotting paper. The filtration of milk was a thing which was much quicker said than done, and he did not think that Mr. Richmond wished them to understand that he had

accomplished the remarkable feat of practically separating milk by running it through a filter into milk serum and milk fat. He, Dr. Vieth, had made a filtration experiment with the following results : 200 c.c. of milk was poured on a plaited filter, after a lapse of one hour, 50 c.c. of the liquid had run through ; after a further lapse of four and a-half hours, 26 c.c. were collected, and 108 c.c. were poured out of the filter. The four liquids were analysed and found to be composed as follows :—

	I. Original Milk.	II. First Filtrate.	III. Second Filtrate.	IV. Milk left on Filter.
Total Solids	13·42	9·14	8·14	13·95
Fat	4·43	·06	·03	4·80
Solids not Fat	8·99	9·08	8·11	9·15
Proteids	3·66	3·68	2·43	3·89

For every 100 parts of water there were present :—

Solids not fat	10·38	9·99	8·83	10·63
Proteids	4·23	4·05	2·65	4·52

The differences in the liquids, II., III. and IV., as compared with the original milk were :—

Solids not fat	...	—0·39	—1·55	+0·25
Proteids	...	—0·18	—1·58	+0·29

As he had made one experiment only, he did not feel justified in drawing final conclusions from it, nor did he wish that anyone else should do so. What he desired was that the results should induce Mr. Richmond to make further experiments in the same direction. No doubt the filtration could be accelerated by bringing the air-pump into requisition, but he should not expect that this would materially influence the composition of the filtrate. He could see three reasons which could account for the differences in Mr. Richmond's and his own results. Mr. Richmond might have worked on the very first portion of the filtrate, or he might have employed a totally different paper, or he might have experimented, not with cow's milk, but with the milk of the gamoose. Milk yielded by different kinds of animals, although apparently composed of the same constituent parts, undoubtedly showed some variations. Mr. Richmond himself had discovered a carbo-hydrate tewfikose in gamoose milk which was not identical with milk sugar. It was also known that whilst it was rather difficult to start alcoholic fermentation in cow's milk, mare's milk would ferment spontaneously. It was further known that there was considerable difference in the behaviour of the proteids present in cow's, mare's, and human milk, and also of the fats of the milk of different kinds of animals.

However, all this had very little to do with the point on which Mr. Richmond and himself differed. They were quite agreed that in the paper process, for the invention of which chemists were so much indebted to Mr. Adams, the conditions for extracting the fat were the most favourable, whatever they might be. Taking the paper process as a standard, it was found that the older methods failed to remove all the fat, or did so with

difficulty, and under certain conditions only. In the case of processes in which an inert substance was not employed, Mr. Richmond, in common with everybody else, was of opinion that the solids not fat imprisoned the fat, so that the solvent can only reach the latter with difficulty. In the case of the plaster process, there was, according to Mr. Richmond, an imprisoning action exercised by the setting plaster, which did not involve the fat alone, but all the milk solids. In Mr. Richmond's opinion, it was justifiable to expect that the more fat there was present, the larger would the amount imprisoned be, and he, Mr. Richmond, held that this explanation was good also in the case of the other obsolete methods. Mr. Richmond gave *one* explanation for *two* totally different facts. It was found in the processes worked without inert matter, that the differences, as compared with the paper process, increased with the increasing difficulties, *i. e.*, the poorer the milk was; but in the plaster process exactly the opposite was the case. He could not see that the plaster-setting-fat-imprisoning theory had brought the question nearer to solution. As he had mentioned already, the point was of no practical consequence, and of little importance, and he should leave the matter where it stood.

Mr. Richmond had alluded to the figures which he, Dr. Vieth, stated represented the proportions of ash, proteids, and sugar in milk. These figures could of course not, be taken as absolutely correct factors for all and every sample of milk. In the composition of the natural product of a living organism, infinite variations must be expected. Taking an average milk containing 8.8 per cent. of solids not fat, the figures formerly published and the figures corrected would give the following proportions:—

	1 : 5 : 6	2 : 9 : 13
Ash	0.73	0.73
Proteids	3.67	3.30
Sugar	4.40	4.77

He believed that the latter figures were, in the majority of cases, nearer to the truth.

Many of the remarks made on the previous paper might be repeated with regard to Mr. Richmond's further paper. There was one point which he would like to draw special attention to, namely, that milks frequently looked fresh and unchanged, after they had developed an appreciable amount of acidity. Quite recently he had had to analyse a stale milk which appeared to be absolutely unchanged and did not curdle when heated to boiling. Nevertheless, when he had dealt with the sample for the fat extraction by the paper process, he could easily trace on the extracted coil the way in which he had run the pipette over the paper. It was marked out by a white line, or rather layer, which could be nothing else but casein.

The Analysis of Sealing Wax. C. Mangold. (*Zeit. angew. Chemie.*, 1892, p. 75).—Sealing wax consists chiefly of shellac and ordinary resin (colophony), to which such matters as chalk, magnesia, plaster of Paris, zinc white &c., are added for giving weight

and diminishing fusibility; also such substances as vermilion, red lead, ferric oxide, &c. for giving colour. The author proposes dissolving out the resinous portions with alcohol, and estimating the proportion of the two resins by the amount of iodine absorbed: the iodine number being approximately 115 for resin and 6 for shellac. He proceeds as follows: 5 gm. of the powdered sample are boiled on the water-bath with 150 c.c. of alcohol in a 250 c.c. flask, cooled, filled up to the mark, and allowed to settle completely. 50 c.c. of the clear fluid are pipetted off, and treated in the usual manner with Hübl's reagent. The undissolved portion is brought on to a tared filter, dried at 120° C., and weighed; the difference gives the amount of the resinous constituents. In an experiment, 5 gms. of sealing wax left 1.74 gms. of undissolved residue, equal to 34.8 per cent.; and hence contained 65.2 per cent. of resins. 50 c.c. of the alcoholic solution treated with Hübl's reagent absorbed 0.4309 gm. of iodine, consequently the iodine number was 66.1. The proportion of the resins was found by the following equation in which k = the amount of the colophony, s that of the shellac, $s = 100 - k$, $i = 66.1$, $i' = 115$, $i'' = 6$,

$$i = \frac{k i'}{100} + \frac{s i''}{100}, \text{ and } k = 100 \frac{i - i''}{i' - i''} = 55.1.$$

The resinous portion consists therefore of 55.1 per cent. colophony and 44.9 per cent. shellac; the sealing wax of 34.8 per cent. insoluble residue, 35.9 per cent. colophony, and 29.3 per cent. shellac.

W. J. S.

Metal Vessels for Laboratory Use. W. Dittmar. (*Chem. Zeit.* 1891, xv. 1521, and 1580-1589.)—(1.) *Copper Evaporating Dishes.* The advent of nickel as a laboratory material has caused the use of copper to be somewhat neglected; nevertheless its cheapness gives it the preference for many purposes, while for large vessels its relative permanency forbids its replacement by nickel-plated iron.

Besides the uses to which it is put in the pharmaceutical laboratory, it is well adapted for preparing baryta solution, and is, moreover, likely to be equally suited for the evaporation of many alkaline fluids, provided ammonia and cyanogen compounds are absent. It must be remembered that although copper is absolutely unattacked by water, the same cannot be said of it when tinned. This point will be referred to later.

(2.) *Globular Copper Flasks.*—The author has used copper flasks for years with success for the distillation of such liquids as alcohol, ether, and benzene, for distillations in a current of steam, and similar purposes. As a joint in such flasks is inevitable, their utility largely depends on the kind of solder used. For many purposes a soft soldered copper flask of about two litres capacity, which is sold in Glasgow as part of a coffee-making apparatus for about ten shillings, serves well. To avoid the presence of soft soldered joints, the author has had a flask of 6.5 litres capacity made of stout untinned copper, with brazed joints, and uses it with satisfaction for purifying and de-hydrating alcohol and ether. The method for the purification of the latter consists merely in keep-

ing the fluid to be de-hydrated over powdered caustic soda, for one or two weeks, in a flask of the kind described, and distilling on the water-bath, whereby a product is obtained, which has scarcely any perceptible action upon sodium.

Soft soldered copper flasks cannot conveniently be used for heating distilled water in place of glass flasks, (from which a certain amount of alkaline silicate is always dissolved) as lead is dissolved from the soldered joint; a copper flask soldered with silver solder is not open to this objection, and might moreover probably be used for caustic lye.

(3.) *Nickel Flasks*.—After several attempts, the author obtained two nickel flasks, soldered with silver solder, from the Westfälische Nickelwalzwerk, each having a capacity of 1.73 litres, and a weight of about 370 grms. The flasks were tested by boiling distilled water in them in free contact with air; in the water thus treated ammonium sulphide gave no precipitate. A second test was made by boiling a solution of 100 grms. of commercial caustic potash in 400 c.c. of distilled water under a vertical condenser, a portion of the liquid being then distilled off, and a sample of that remaining in the flask taken and tested for nickel. A trace of dissolved nickel was detected as soon as 100 c.c. had been distilled off, but a sample taken when 350 c.c. had been distilled off was free from nickel. An attempt was made to prepare caustic soda free from carbonate, by treating sodium carbonate with lime, and evaporating the clear liquid, by boiling it down briskly, in one of these nickel flasks, but without success, the product containing 0.96 of carbonic acid. A nickel flask of 800 c.c. capacity, obtained for the author by Baird and Tatlock, yielded a trace of metal in solution, on boiling with distilled water, apparently because it was brazed instead of being soldered with silver solder. Attention is called to the fact, that Fleitmann and Witte make sheet nickel, mechanically covered on both sides with platinum. This would be available for the construction of metallic laboratory vessels, although somewhat dear.

(4.) *Gold and Silver Vessels*.—The author has, in past years, made repeated attempts to obtain vessels unattacked by caustic alkalis. He points out that the current idea that gold and silver vessels are unaffected by caustic alkali is erroneous; it may be true for caustic soda but is absolutely false for caustic potash. The reason why the “*Kalium hydricum purissimum*” of Trommsdorff or Merck is quite white is that it contains more water than corresponds to the formula KOH . On attempting to de-hydrate it by fusion in a silver dish, oxygen is absorbed from the air, and silver from the dish immediately a certain point is passed; the material cannot therefore be at once anhydrous and pure. A similar result is obtained when gold, alloyed with 10 per cent. of silver is used, though a smaller quantity of water suffices to protect the metal from attack. Pure gold may do better; it is, however, doubtful. The purest caustic potash that the author was able to prepare, contained potassium carbonate and water, as well as a trace of gold (0.1 per cent.), sufficient to give it a dark brown colour. Laurent says “*La chimie est la science des corps qui n'existent pas,*” but the author hopes to give KOH a real existence

B. B.

A Method for the Determination of the Specific Gravity of Powdered Substances. W. J. Smeeth. (*Zeits. Krystall*, 1891, 483, through *Chem. Zeit.*)—Vaselene is placed in a small watch glass, warmed to expel air bubbles, cooled, and the whole weighed in water. The watch glass with the vaselene is then removed from the water, again warmed, and a weighed quantity of the powder, the specific gravity of which is to be determined, sprinkled upon it; after cooling and weighing again in water, the specific gravity can be found by an obvious calculation.

B. B.

The Determination of Cholesterin. K. Obermüller. (*Zeits. Physiol. Chem.* xvi. 143, through *Chem. Zeit.*)—The first method proposed by the author depends on the method of saponifying fats by means of sodium ethylate, due to Kossel and Kruger (*THE ANALYST*, xvi., p. 178.) One grm. of the fat (*e.g.*, tallow filtered and dried at 120°C.) was, for the purpose of testing the method, mixed with a weighed quantity of cholesterin, dissolved in ether, and treated with sodium ethylate, produced by dissolving 0.15 grm. of sodium in the smallest possible quantity of 90 per cent. hot alcohol. The sodium ethylate is added to the ethereal fat solution and well shaken; saponification is complete after the mixture has been allowed to stand for three hours at the ordinary temperature. The quantity of alcohol used should not exceed 1 to 1.5 c.c.; the solution of the ethylate should solidify on cooling. The quantity of ether used must be sufficient to allow the soap formed to float freely in the liquid; about 80 c.c. is generally enough. After the mixture has been allowed to stand for three hours, the soap is transferred to a filter and washed with ether, which, if anhydrous, causes the precipitation of a further small quantity of soap, which is removed by a second filtration. The ethereal solution is then distilled, and the residue dried at 100 to 120°C. Purification is effected by treatment with a small quantity of absolute ether, the solution being allowed to stand for some hours and filtered from the small residue of soap; distillation, and drying as before, complete the process. The method only gives good results with solid fats.

The author describes another method in which the cholesterin, obtained as in the previous process, is dissolved in carbon disulphide, and titrated with a solution of bromine in the same solvent, until a yellowish-red colouration appears; the results were satisfactory. It is at present unknown how bromine behaves with bodies analogous to cholesterin; the author has found that isocholesterin, like cholesterin itself, combines with two atoms of bromine, but no figures have yet been recorded for phytosterin, caulosterin and ambrain.

B. B.

Determination of Fat in Milk Products. Leze and Allard. (*Compt. Rend.* cxiii. 654, through *Chem. Zeit.*)—The process depends upon the same principle as that of Schmid, in which the casein of milk is dissolved by heating with strong hydrochloric acid, but differs therefrom inasmuch as the acid is afterwards neutralised with ammonia,

warm water added, and the volume of the fat itself read off in the graduated neck of the flask in which the reaction is conducted. An improvement in this process has now been effected by allowing the hydrochloric acid to act for several hours at 25 to 30° C. The acid should be free from free chlorine, otherwise a flocculent precipitate forms, and an evolution of gas takes place, which make the measurement of the volume of fat difficult; the addition of ammonia may be omitted.

The process can be applied to the determination of fat in various milk products, such as cream and cheese, as well as in margarine. The substance to be examined is treated in a flask with a graduated neck, with 4 or 5 times its volume of pure concentrated hydrochloric acid, and allowed to remain for some time at a moderate temperature with frequent shaking. The substance dissolves to a clear brown liquid from which the fat separates; by the addition of warm water, the fat can be brought into the graduated neck and there measured. If the substance be troublesome to introduce into a flask, the treatment with acid may be carried out in a dish, and the resulting solution transferred to the graduated vessel. The author found in a sample of Gruyere, 31.75 per cent. of fat, against 31.84 per cent. by extraction with ether, and 32.04 by treatment with carbon disulphide. In this particular instance the reaction took place easily when 10 grms. of cheese were digested with 50 grms. of hydrochloric acid for about half-an-hour, and heated on the water-bath until the solution assumed a brown colour. The observed volume of fat can be calculated into grms. by multiplication by 0.9, or 9 grms. can be taken and the volume read off at once in percentages without correction. B. B.

A Reaction of Cerous Oxide. P. C. Plugge. (*Archiv. der Pharmacie*, ccxxix 558-561).—In some pharmacopœias cerium oxalate has been incorporated among the remedies for vomiting, dyspepsia, and catarrh of the stomach and intestines, and the author has met with a case in which cerium oxalate occurred in the contents of a stomach submitted for analysis for poison. It thus becomes necessary to have a delicate test for cerium oxide; such is supplied by a solution of 1 part of strychnine in 1000 parts of strong sulphuric acid. A little of the solution supposed to contain cerium is made just alkaline with sodium hydroxide, evaporated to dryness on a piece of porcelain, and the residue mixed with 2 or 3 drops of the strychnine solution. A bright blue colour, which shortly gives way to a more permanent cherry-red or pale-red colour, is indicative of cerium. One-tenth of a milligram of cerous oxide will give the bright blue colour, while one hundredth of a milligram will give a pale and fugitive blue-violet colour, about which, however, there is no uncertainty.

Cerium oxalate will not give the reaction without the presence of sodium hydroxide. The test will answer in the presence of zinc and aluminium in a precipitate obtained by ammonia, but not if ammonium sulphide or zinc sulphide be present. A. G. B.

Test for Phenacetin. W. Autenrieth and O. Hinsberg. (*Archiv. der*

Pharmacie, cccxix., 456).—In a paper on the derivatives of phenacetin, the authors point out that phenacetin may be distinguished from its fellow antipyretics—antifebrin and antipyrin—by boiling the suspected substance with dilute nitric acid (10–12 per cent.) for a short time. Phenacetin is thus nitrated, and the nitro-derivative colours the nitric acid solution yellow or orange, whereas a similar solution of antifebrin and antipyrin remains colourless. When the yellow solution is cooled, the nitro-phenacetin crystallizes in yellow needles.

A. G. B.

On the Estimation of Potassium as Perchlorate. W. Wense. (*Zeitsch. f. angew. Chem.* 1891, p. 69.)—The perchlorate method has been generally abandoned on account of the solubility of the potassium salt in water or alcohol, one part of the salt requiring 6,400 parts of 97 per cent. alcohol, about 5,000 of 95·8 per cent., and 2,500 to 3,000 of 90 per cent. According to the author, a mixture of two parts by volume of 97 per cent. alcohol and one part of ether, dissolves only 1/25,000 part of potassium perchlorate. He further found that the solubility was much diminished in presence of perchloric acid, and of the sodium, magnesium, and barium salts of that acid. He therefore uses for the purpose of washing the precipitated potassium, perchlorate, alcohol to which a small quantity of perchloric acid has been added. He operates as follows:—The salts to be analysed must be free from sulphates and from non-volatile acids. He evaporates them with an excess of perchloric acid in a well-glazed china basin until no more hydrochloric or other acid vapours escape. To the residue about 10 c.c. of alcohol are added, containing 0·2 per cent. of perchloric acid, the precipitate is rubbed with a glass rod, the fluid poured upon a weighed filter, and the precipitate brought upon it with the acid alcohol mixture. It is then washed with a few c.c. of pure alcohol, and dried at from 120 to 130°C., one part of perchlorate corresponding to 0·5382 KCl, or 0·6289 K₂SO₄. A number of test experiments are given which are entirely satisfactory.

O. H.

The Attack of Chrome Iron Ore by Hydrochloric Acid under Pressure. P. Jannasch and H. Vogtherr. (*Ber.* xxiv. 3206–3208.)—The mineral can be attacked either in a tube of hard potash glass, if the content of chromium only be required, or in Jannasch's platinum apparatus (*Ber.* xxiv. 273), if a complete analysis be undertaken. The substance must be powdered with the same care as is exercised in the ordinary fusion methods of attack. About 1 grm. of the chrome iron ore is mixed with 2 grms. of ammonium chloride and 10 c.c. of hydrochloric acid (4 vols. of the acid of sp. gr. 1·119 and 1 vol. of water) saturated with ammonium chloride by shaking with excess of that salt and heated in a sealed tube for 8–10 hours at 275°–290°C. Test analyses, in which the insoluble residue left by this treatment was treated with hydrofluoric acid and sulphuric acid to remove silica, showed that the quantity of unattacked ore ranged from 0·17 per cent. to 1·22 per cent., the latter somewhat high figure being due to the imperfect pulverisation of the mineral.

B. B.

The Quantitative Separation of Manganese and Nickel, Manganese and Cobalt, and of Manganese, Cobalt, and Nickel. P. Jannasch and C. J. Franzek. (*Ber.* xxiv. 3204, 3205.)—One of the authors, in conjunction with Mac Gregory, some time ago published (*J. f. Prakt. Chem.* xliii. 402) a method of separating manganese and zinc by means of hydrogen peroxide in strongly ammoniacal solution in the presence of much ammonium chloride. The present coadjutors find that manganese and nickel can be separated in the same manner; they failed, however, in their attempt to apply the method to manganese and cobalt, the latter being carried down in considerable quantity and not being removeable even by repeated treatment. The object in view was eventually attained by using hydrogen peroxide as a precipitant in a solution of the double cyanides of the metals in the presence of potash. Under these conditions, the manganese is precipitated quite free from cobalt. The method is applicable to the case of nickel and manganese. The exact conditions necessary for success will be published in a later paper. B. B.

The Micro-Chemical Detection of Sulphurous Acid. G. Deniges. (*J. Ph. Chim.* 1891, xxiv. 289, through *Chem. Zeit.*)—The reactions generally in use for the detection of gaseous sulphurous acid do not suffice to discriminate between it and other reducing gases, notably sulphuretted hydrogen. The method used by the author consists in exposing a glass rod, wet with a mixture of chlorine water, hydrochloric acid, and barium chloride, to the suspected gas, and in recognising the crystals of barium sulphate, which are lozenged-shaped, and either isolated or united in cruciform groups, under the microscope. The absence of vapour of sulphuric acid is first ascertained by making a test with barium chloride solution acidulated with hydrochloric acid, in a precisely similar manner.

A second test is described, depending on the formation of one of the very sparingly soluble crystalline compounds of metallic sulphites with primary aromatic amines, already investigated by the author. A saturated solution of cadmium nitrate is diluted with twenty times its bulk of a solution of aniline, containing 20-25 grms. per litre. Just before being used, a small quantity of this mixed solution is treated with about 190 times its volume of acetic acid. A glass rod dipped in this mixture and exposed to an atmosphere containing sulphurous acid is speedily covered with a white film, which seen under the microscope consists of very regular hexagonal plates. When the reagent is not acidified, the reaction is more sensitive, the precipitate forming more rapidly; but the hexagonal plates are replaced by much less characteristic radial crystals. B. B.

Metatitanic Acid and the Determination of Titanium by means of Hydrogen Peroxide. F. P. Dunnington. (*J. Amer. Chem. Soc.* 1891, xiii. 210, through *Chem. Zeit.*)—The detection and determination of small quantities of titanate have

been facilitated by the method due to A. Weller, which depends upon the formation of an intense yellow colouration when hydrogen peroxide is added. Exact results are obtained if the product of the fusion of the titanous acid, to be determined with sodium bisulphate, is dissolved in sulphuric acid of not less than 5 per cent. strength; the results are low when the acid is weaker. A similar defect is observed when a weak acid solution of titanium sulphate is diluted, heated until partial precipitation has taken place, the precipitate re-dissolved in sulphuric acid, and hydrogen peroxide added. The author has found that these phenomena are due to the presence of metatitanous acid.

Metatitanous acid can be isolated by heating a dilute solution of titanium sulphate to 100°C ., gradually adding ammonia in excess, filtering and warming the washed precipitate with hydrochloric acid, in which a portion remains almost insoluble. After washing once or twice by decantation with cold water, whereby most of the hydrochloric acid is removed, the residue is found to be completely and readily soluble in water. On treating the above-mentioned precipitate with hydrochloric acid and removing the latter by evaporation upon the water bath, a scaly residue is left of gelatinous aspect which gives an opaline solution in water, and contains one molecule of water to each molecule of titanous acid; thus having the same composition as that assigned by Merz to air-dried metatitanous acid. The aqueous solution of metatitanous acid gives a white precipitate with hydrogen peroxide instead of a yellow colouration. It therefore appears that after the fusion of titanous acid with sodium bisulphate and digestion with water only, the solution contains some metatitanous acid, which gives no yellow colouration with hydrogen peroxide; it is therefore necessary in using Weller's process to have sufficient sulphuric acid present to prevent the formation of a precipitate, even in warm solutions; 5 per cent. is enough for this purpose.

B. B.

Detection of Vegetable Fatty Oils in Lard. P. Welmans. (*Pharm. Zeit.* 1891, p. 798, through *Zeit. angewand. Chemie.*)—If 2 c.c. of phosphomolybdic acid are added to 1 gm. of a fatty oil dissolved in 5 c.c. of chloroform, and the mixture well shaken, it becomes of an emerald green color, owing to the reduction of the reagent. On standing the fluid separates into two layers, the lower chloroform one, which was originally of a yellow tint, is now colorless; the upper layer exhibits a beautiful green coloration. If the acid fluid be supersaturated with ammonia or other alkali, the green colour changes to a blue, corresponding in intensity to that of the original green colour. The reaction shows itself with nearly all vegetable fatty oils; those, which have been chemically treated, either for the purpose of being bleached or for the removal of acidity, do not respond to the test at all, or only in a feeble manner, and that after standing some time. Lard, goose fat, tallow, deer fat, butter fat, &c., show no change in colour, on being treated with this reagent either with or without the addition of alkali. The presence of a small quantity of vegetable fatty oil betrays itself by the appearance of the above mentioned coloration, the intensity of which forms an approximate measure of the quantity of vegetable oil present in the sample. In experiments with American lards,

which deviated in their iodine absorption numbers from that of genuine lard, the results were concordant, the color deepening as the iodine figure rose. The mineral fats (paraffin, vaseline), are without action on this reagent, and the only animal fat which reduces it is cod liver oil.

If to 10 c.c. of oil a cold saturated solution of picric acid in ether be added, and the latter be allowed to evaporate slowly away, the acid remains dissolved in the oil, to which it communicates a brown color. This reaction can be used for the detection of cotton seed oil in lard, which, when pure, after the ether has evaporated, appears of a citron yellow color; if, however, cotton seed be present, the mixture assumes a brown red color.

W. J. S.

The Essential Oil of Lemons. V. Oliveri. (*Gaz. Chim., Italiana* 1891, 318.)—

The essential oil of lemons consists of about 60 per cent. of a limonene, $C_{10}H_{16}$, b. p. 170° — 170.5° , density 0.8867, $[a]_D$ 64.82° , forming a tetra-bromide and a di-chlorhydrate, about 90 per cent. of a limonene $C_{10}H_{16}$, b. p. 176° — 178° , density .8990, $[a]_D$ 76.75° , forming a tetra-bromide and a dichlorhydrate; both these limonenes give a red colour with sulphuric acid in acetic solution, and a small quantity of a sesqui-limonene $C_{15}H_{24}$, b. p. 240° — 242° , density 0.9847, inactive, and forming a tetra-bromide and a dichlorhydrate. In acetic solution it gives a brown colour with sulphuric acid.

Essential oil of lemons is often adulterated with turpentine; this can be detected by the following properties; turpentine from the *Pinus Maritimus* (French turpentine) gives a mono-chlorhydrate containing 20 per cent. Cl against 33.97 per cent. in di-limonene-chlorhydrate; this method of detecting adulteration is scarcely practical, and the author bases his method of distinction on the specific rotary power; in ten samples he finds the density to vary from 0.856 to 0.865, and the rotation in a 200 m.m. tube from 117° to 123.6° , while French turpentine gives density 0.870 to 0.881, and rotation in 200 m.m. tube— 45.5° to 64.0° ; Russian turpentine from *P. sylvestris* gives a rotation of about 21° , and American turpentine from *P. australis* about 23° .

Any rotation then of less than 116° should be considered as indicating adulteration.

H. D. R.

OBITUARY.

The late Dr. A. J. BERNAYS.

We regret to have to announce the death of this gentleman, which took place on the 5th of January last. He was one of the earliest members of the Society of Public Analysts, and for some time a member of its Council. For thirty-one years Dr. Bernays was lecturer on Chemistry at St. Thomas's Hospital, having previously held a similar position at St. Mary's Hospital, and he was examiner in Chemistry to the Colleges of Physicians and Surgeons. As Public Analyst for St. Giles, Camberwell, and St. Saviour's, Southwark, he was intimately connected with the working of the Sale of Food and Drugs Act. His amiable manners, his modest and genial disposition, gained for him the esteem of all those with whom he was brought in contact.